

EXHIBIT 1

**UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS**

SINGULAR COMPUTING LLC,

Plaintiff,

v.

GOOGLE LLC,

Defendant.

Civil Action No. 1:19-cv-12551-FDS

Hon. F. Dennis Saylor IV

**PLAINTIFF SINGULAR COMPUTING LLC'S
RESPONSIVE SUPPLEMENTAL CLAIM CONSTRUCTION BRIEF**

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Plaintiff, Singular Computing LLC (“Singular”), respectfully submits this Responsive Supplemental Claim Construction Brief addressing the Supplemental Brief filed by defendant, Google LLC (“Google”), on March 16, 2021 (Dkt. No. 146).

I. INTRODUCTION

At the most recent Status Conference, Google asked the Court for permission to file a third, “Supplemental” Brief in order to present testimony from the deposition of Singular’s technical expert, Dr. Sunil Khatri, that allegedly would reveal inconsistencies between Dr. Khatri’s opinions in this case and “positions Singular has taken in the IPRs.” *See* Dkt. No. 142 at 5. Google’s Supplemental Brief however, does not identify a single such inconsistency. Instead, Google mischaracterizes Dr. Khatri’s deposition testimony and crops Dr. Khatri’s declaration.¹

Specifically, Google first argues that Dr. Khatri’s testimony “confirms” that the claimed “statistical mean over repeated execution” is indefinite. Google Supp. Br. at 1. This is patently incorrect. Dr. Khatri, in fact testified that the scope of this term is “as clear as daylight” and that

¹ On page 2 of its brief, Google twice crops paragraph 33 of Dr. Khatri’s declaration and misstates the content of his deposition at page 52, lines 10-16. The cropped portion of the declaration states:

“and initially, a fluctuating arithmetic *average*. However, a POSITA would understand that the output values of repeated executions of the same operation must exhibit the following statistical behavior for the computer to be usable: the average of those output values, over repeated executions, goes from being an arithmetic average that potentially has an unstable value when computed based on a small number of executions, to a stable statistical mean that does not meaningfully fluctuate. Moreover, once enough repeated executions have occurred, that statistical mean no longer materially changes no matter how many more repeated executions are conducted over the useful life of the computer.”

With respect to Dr. Khatri’s deposition testimony, such testimony was with regard to only line 2 of paragraph 33 of his declaration. Line 2 dealt with the “initial” fluctuations in his graph, not the “statistical mean” as explained in detail in the above.

it is “quite clear as to what the person of ordinary skill in the art needs to do” to determine whether this limitation is met. *See* Ex. A (Khatri Dep. Tr.) at 29:1; 25:18-20.

Google then claims that Dr. Khatri’s testimony supports its attempt to rewrite the asserted claims by replacing the word “signal” with the word “value.” Supp. Br. at 1. But again, Dr. Khatri rejects this position, confirming that the claimed LPHDR execution unit “performs operations on input signals,” and that the distinction between signals and values is “important to make.” Ex A at 132:12-17.

II. ARGUMENT

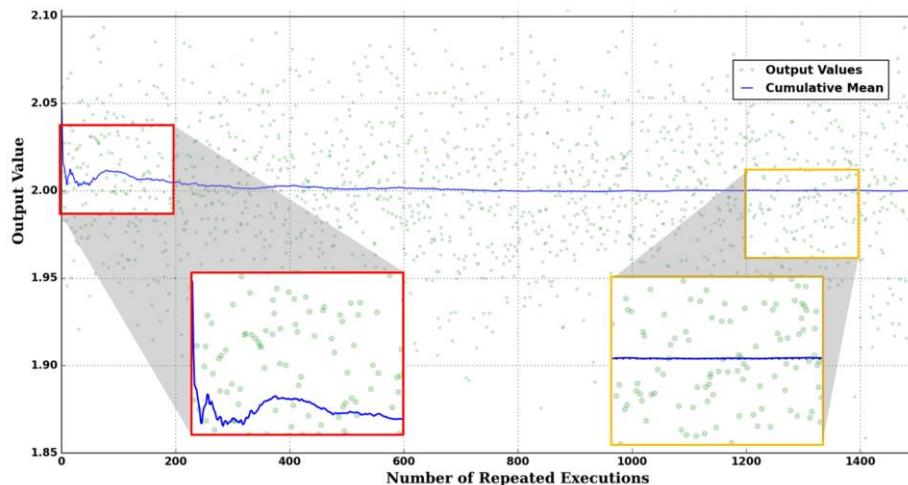
A. “Repeated Execution”

Google’s indefiniteness argument is premised on its argument that the term “repeated execution” does not specify exactly how many executions are necessary to infringe. Google Third Br. (Dkt. No. 146) at 1. In making this argument, Google ignores that the claim recites “statistical mean, over repeated execution.” In addition, Google’s technical expert, Dr. Gu-Yeon Wei, offers no evidence that one of ordinary skill in the art, with knowledge of fundamental “statistical” analysis, could not determine a “statistical mean, over repeated execution.” Nor does Google or Dr. Wei contest or even mention Dr. Khatri’s graph depicting the ease of determining infringement.

Throughout Dr. Khatri’s Declaration, Singular provides evidence that, as the number of repeated executions increases, the average of the output values stabilizes to a fixed value, which is the claimed “*statistical mean*.” *See* Khatri Decl. (Dkt. No. 135-1) at ¶¶ 34-35. Dr. Khatri explains that this is due to a statistical principle known as the “Law of Large Numbers,” which a person of ordinary skill in the art would have learned in an undergraduate college statistics

course. *Id.* Google and Dr. Wei however chose to ignore this basic law of statistics, and the conjoined claim term “statistical mean.”

Dr. Khatri supports his opinions with undisputed experimental evidence. As Dr. Khatri explains in his Declaration and his deposition testimony, he performed the same analog circuit simulation as Dr. Wei, with exactly the same parameters, but with 1,500 executions instead of 10. *See, e.g.*, Khatri Decl. (Dkt. No. 135-1) at ¶ 34. The results of his experiments are illustrated in the graph below and show, as the number of repeated executions increases, that the average of the outputs stabilizes to a constant value, which is the claimed statistical mean:



See Khatri Decl. (Dkt. No. 135-1) at ¶ 34; *see also* Ex. A (Khatri Dep. Tr.) at 70:16-71:14; 72:21-74:13. Notably, neither Google nor Dr. Wei address this graph, nor do they acknowledge that the average output value of a usable analog circuit, stabilizes over time to a calculable “statistical mean.” *See* Khatri Decl. (Dkt. No. 135-1) at ¶¶ 33, 34.

Google now attempts to dismiss Dr. Khatri’s opinion as “not just *ipse dixit*, but multiple levels of *ipse dixit*.” *See* Google Supp. Br. at 3. Not so. Dr. Khatri a distinguished Professor of Electrical and Computer Engineering with hundreds of peer-reviewed publications conducted an experiment that *proves* on its face that the average output value after repeated execution

stabilizes to the claimed statistical mean, in less than a millionth of a second. *See* Khatri Decl. (Dkt. No. 135-1) at ¶ 34. In contrast, Dr. Wei avoided any discussion of the laws of statistical analysis and how these laws apply to the behavior of analog circuits (*see* Sing. Reply. Br. (Dkt. No. 135) at 8), and conveniently stopped his experiment after just 10 executions, before the stability of the statistical mean could be revealed. *See* Wei Decl. (Dkt. No. 114) at ¶ 39 (describing a test involving just “ten hypothetical executions”). In view of the above, Google’s third brief only highlights the material disputed facts and the premature nature of its invalidity motion.

B. The Claimed Execution Unit Operates On Signals, Not Values

Both of Google’s proposed claim constructions impermissibly seek to rewrite the claims by replacing the term “signal” with the term “value.” Google’s construction contradict the plain language of the asserted claims as written, the testing of Dr. Khatri, and even the declaration of its own expert Dr. Wei and thus must be rejected.

The claimed “execution unit” operates on “signals” that *represent* numerical values, and do not perform operations directly on values. *See, e.g.*, Sing. Open. Br. at 12. This position is fully consistent with Dr. Khatri’s deposition testimony, which explains how the claimed “operation”, which is performed on signals, is distinct from the corresponding arithmetic that is performed on values:

“[a]n LPHDR execution unit performs operations on input signals, you know, which have values ... this arithmetic is done based on numbers which are represented by voltages. So the operations — in this statement it’s quite clear that the operation is done on voltages, and that results in numbers that these voltages represent, just as shown in the claims of the patent.”

Ex. A (Khatri Dep. Tr.) at 132:16-17 and Dr. Wei’s declaration (Dkt. No. 114) at ¶ 21 (“Variances in these signals represent different numerical values”). Singular’s position has never changed regarding this term.²

Google’s position on this term however has changed with each new round of briefing. In its opening brief, Google based its argument on the premise that “the ‘first input signal’ cannot have a dynamic range” Google Open. Br. (Dkt. No. 111) at 19. However, as Dr. Khatri explained in his Declaration, “this assertion is technically incorrect.” In its latest brief, Google admits that its original premise was incorrect. *See* Google Supp. Br. at 7 (“Google agrees that signals themselves can have dynamic ranges”).

For the reasons given above and in Singular’s previous briefs, Singular submits the claim terms proposed by Google be given, as Google represents in the IPR, their plain and ordinary meaning.

III. CONCLUSION

For the reasons set forth above, Singular requests that the Court adopt Singular’s sole proposed construction and reject Google’s proposed constructions and invalidity positions.

² Google asserts that various statements made by Singular and Dr. Khatri in the related IPR proceedings support its attempt to read the term “signal” out of the claim. *See* Google Supp. Br. at 6. When read in context, however, these statements only argue that the claims are not limited to any particular *type* of signal, and clearly do not support the proposition that the claims require no “signals” at all.

Dated: March 19, 2021

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that all counsel of record who have consented to electronic service are being served with a copy of this document via the Court's CM/ECF system.

/s/ Paul J. Hayes

EXHIBIT A

UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

VIDEOCONFERENCE DEPOSITION OF SUNIL KHATRI
Friday, March 12, 2021
Volume I

Reported by:
KATHLEEN E. BARNEY
CSR No. 5698
Job No. 4483047
PAGES 1 - 165

1 BY MR. KAMBER:

2 Q And I'm just asking -- I'm not trying to make
3 this more complicated than it seems, Dr. Khatri.
4 I'm really just asking -- I mean, we've talked about
5 the claim language, and it uses "differs by." There 12:30:14
6 is some analysis of comparing an output result from
7 the LPHDR execution unit to the output of an exact
8 mathematical calculation, correct?

9 MR. SEEVE: Objection. Mischaracterizes the
10 claim. Asked and answered. Vague. 12:30:33

11 THE WITNESS: So, again, you know, there's
12 language that I've read out to you and that's very,
13 very clear. And there's a test that wants to be
14 done, and that test asks the person of ordinary
15 skill in the art to see if, you know, the numerical 12:30:51
16 values of the first output when they're executing
17 that first operation differ by a certain amount.

18 Now, that's the plain language and that's
19 basically quite clear as to what the person of
20 ordinary skill in the art needs to do here. 12:31:10

21 BY MR. KAMBER:

22 Q Can you tell whether a number differs from
23 another number without comparing them?

24 MR. SEEVE: Objection. Incomplete
25 hypothetical. Vague. 12:31:20

1 to be tested. And that's as clear as daylight
2 because it says that in the claim language.

3 BY MR. KAMBER:

4 Q Does the term "repeated execution" have any
5 practical effect with respect to a digital 12:35:16
6 embodiment?

7 MR. SEEVE: Objection. Calls for
8 speculation. It goes outside the opinions presented
9 in the declaration at issue here.

10 THE WITNESS: So I would request you to point 12:35:32
11 me to a portion of my declaration where you're
12 referring to for this question.

13 BY MR. KAMBER:

14 Q Your declaration says that -- does an
15 analysis with respect to analog embodiments, 12:35:46
16 correct?

17 A Once again, can you show me the specific
18 language, please?

19 Q The language of what?

20 A That you're referring to from my declaration. 12:35:58
21 Like the paragraph that you want -- that you're
22 referring to.

23 THE VIDEOGRAPHER: Dr. Khatri, could you
24 please adjust your camera so you're more in the
25 center of the picture? 12:36:15

1 Q And when you're referring to a fluctuating
2 arithmetic average, I'm just asking if the
3 statistical mean of the results after repeated
4 execution is going to shift; it might be above the
5 claimed degree of inaccuracy or it might be below
6 the degree of inaccuracy claimed in the patents? 01:14:53

7 MR. SEEVE: Objection. Vague.

8 Mischaracterizes the testimony. Mischaracterizes
9 the declaration. Mischaracterizes the claim.

10 THE WITNESS: So what line 2 means is that 01:15:09
11 when you perform the same operation twice -- so if
12 you apply the same exact inputs, right, then there
13 is statistical variation in the output values. So
14 that's -- you know, based on that initially, we --
15 the arithmetic average would be varying, it would 01:15:34
16 fluctuate, is what this line explains.

17 BY MR. KAMBER:

18 Q And when you say that it fluctuates, that
19 might mean it's above or it might be sometimes below
20 the claimed degree of inaccuracy, correct? 01:15:50

21 MR. SEEVE: Objection. Mischaracterizes the
22 witness's testimony. Mischaracterizes the
23 declaration.

24 THE WITNESS: I mean, it says it will
25 fluctuate. This -- this line in and of itself 01:16:00

1 don't know how to answer your question because I
2 don't know how you would track, and I don't know
3 what words you used. Track and calculate the
4 outputs of the processor or something?

5 BY MR. KAMBER:

6 Q That's correct, Dr. Khatri. In order to
7 calculate the statistical mean of a repeated
8 execution of a particular operation on particular
9 inputs, you would have to track the number of times
10 that particular calculation was performed on those 01:38:28
11 particular inputs, correct?

12 MR. SEEVE: Objection.

13 THE WITNESS: So, again, this is all
14 mischaracterizing my declaration and also whatever I
15 might have said to you right now. 01:38:43

16 The way one would calculate, you know, the
17 statistical mean is shown in my declaration in
18 paragraph 34, right, where I basically do the same
19 experiment that Dr. Wei conducted, and I have a
20 little plot that shows the results from that 01:39:02
21 experiment. And in that -- in that plot, you know,
22 there is a blue line that indicates the -- the --
23 you know, the -- you know, if you look at the plot
24 on paragraph 34, right, there is basically a value
25 that has an average of 2.0, and it varies from that. 01:39:26

1 So, for example, if you look at page 10, the
2 fifth line, there's a blue line that is the average
3 of the -- sort of the green dots that are the
4 different samples. And the blue line shows the
5 average of the output values for the first X number 01:39:53
6 of samples or for the X -- first X repeated
7 execution.

8 So when X is 10, the blue line represents the
9 average of the first 10 values or the first 10
10 executions. And as you can see in that plot, the 01:40:18
11 blue line varies in the beginning, fluctuates in the
12 beginning, but then it stabilizes, you know, as the
13 number of repeated executions increase. And that's
14 the statistical mean.

15 BY MR. KAMBER: 01:40:42

16 Q You said the blue line on -- in paragraph 34
17 is the statistical mean?

18 A That's not what I said.

19 MR. SEEVE: Objection. Mischaracterizes the
20 witness's testimony. 01:40:55

21 THE WITNESS: That's not what I said.

22 BY MR. KAMBER:

23 Q Okay. I'm sorry, maybe I misread. You said:

24 "The blue line varies in the
25 beginning, fluctuates in the 01:41:02

1 beginning, but then it stabilizes, you
2 know, as the number of repeated
3 executions increase, and that's the
4 statistical mean."

5 That's what you said, correct, Dr. Khatri? 01:41:12

6 A Let's see.

7 Q The question is just if that's correct. Did
8 you say that? Did you say those words? That's my
9 only question, Dr. Khatri.

10 MR. SEEVE: I'm sorry. Matthias, I'll ask 01:41:22
11 you to give Dr. Khatri a moment -- time to answer.
12 You asked him if he said a whole bunch of very
13 specific text. Dr. Khatri needs to verify if he, in
14 fact, did say that text.

15 MR. KAMBER: Okay. 01:41:36

16 THE WITNESS: I would need to read that,
17 Matthias. Let me see where that is in that
18 transcript.

19 BY MR. KAMBER:

20 Q It's page 60, line -- starting at line 20. 01:41:43

21 A I'm not able to see -- hold on.

22 I'm not used to this transcript thing, so --
23 you guys must be very used to it, but I'm not.

24 Okay. How about this, right? I'll just sort
25 of scratch that out, just sort of repeat this for 01:42:09

1 you. How's that? Just make sure we get the -- you
2 know, get this right without any more further
3 clarification.

4 So I'm going to point you to a portion of
5 paragraph 34 on line 10. Probably all of it, but I 01:42:20
6 can read the portion that is more relevant to what
7 we just discussed.

8 There we go. Okay. So let's go to -- I'm
9 going to read you paragraph 34, from line 6 of it,
10 at the beginning of line 6 on page 10. It says: 01:42:43

11 "At first, near the left side of
12 the graph, the arithmetic average of
13 the output value is unstable and
14 fluctuates significantly over short
15 periods of time." 01:42:55

16 And in parentheses:

17 "As shown by the magnified
18 portion of the graph outlined using
19 the red box," close paren.

20 "However, the arithmetic average 01:43:06
21 of the output value begins to
22 stabilize with more repeated
23 executions of that single operation,
24 holding steady at a value of 2.00.

25 Therefore, no matter how many other 01:43:20

1 repeated executions are added, the
2 arithmetic average of the output value
3 never varies from 2.00 by more than a
4 few hundredths of a percent, as shown
5 by the magnified portion of the graph 01:43:35
6 outlined in orange. This portion of
7 the graph represents the statistical
8 mean over repeated execution of the
9 first operation recited in the
10 claims." 01:43:48

11 So this is basically what I was saying. And
12 I just want to make sure that that's what you
13 understood.

14 Q Let me ask a question about the chart that
15 you were just describing. There is a reference to 01:43:59
16 the blue line and in the key it says, "cumulative
17 mean."

18 Do you see that?

19 MR. SEEVE: Objection. Vague.

20 THE WITNESS: Yes. The legend in the 01:44:17
21 graph --

22 BY MR. KAMBER:

23 Q Yes.

24 A -- shows the blue line as cumulative mean.

25 Q What is a cumulative mean? 01:44:23

1 testimony. Calls for a legal conclusion. Calls for
2 speculation about matters not included in
3 Dr. Khatri's declaration in this case.

4 THE WITNESS: So it's important to understand
5 the statement carefully. And I can see how you're 03:22:06
6 very easily liable to misunderstand it.

7 It's talking about performing -- when we talk
8 about arithmetic at a high level, you know -- you
9 know, we're operating on numbers. But the actual
10 LPHDR units or the circuits would be operated on, as 03:22:33
11 the claim suggests, on actual -- you know, on input
12 signals and output signals, which have values. So
13 that distinction is important to make. And I can
14 see where that might be confusing to you when you
15 read this language. 03:22:50

16 An LPHDR execution unit performs operations
17 on input signals, you know, which have values. But
18 when we talk about it broadly or globally, when we
19 say we're doing LPHDR arithmetic, it's kind of a
20 high level statement. That's just saying that, you 03:23:20
21 know, we're operating -- you know, that this
22 arithmetic is done based on numbers which are
23 represented by voltages.

24 So the operations -- in this statement, it's
25 quite clear that the operation is done on voltages, 03:23:30